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Fleas (Insecta: Siphonaptera) from small mammals in the Čergov Mountains (Western Carpathians, Czechoslovakia)*

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The paper is dedicated to the memory of Tibor WEISZ (1914—1983).

ABSTRACT. A total of 419 specimens of insectivores and rodents of 11 species were captured and examined for parasites in the course of the years 1974-1975 and 1980-1982. From their bodies 926 specimens of fleas of 19 species were collected, including some material from pitfall traps. The following most numerous and dominant flea species represented 85.3% of the whole material: Ctenophthalmus agyrtes kleinschmidtianus (37.6%), Amalaraeus penicilliger kratochvili (21.0%), Palaeopsylla soricis starki (8.3%), Amalaraeus arvicolae (7.1%), Ctenophthalmus uncinatus (4.9%), Megabothris turbidus (5.2%).

Literature data on fleas are available from neighbouring parts of the Polish Carpathians, as published by HAITLINGER (1974, 1978). The area under study is of zoogeographical importance as it lies on the east border of the Western Carpathian subsystem. This opinion was confirmed by the species composition of the flea fauna of small mammals. The first report on the flea fauna of small mammals in Čergov Mts is given in this paper.

MATERIAL AND METHOD

A total of 419 insectivores and rodents were captured by snap traps at the following localities and dates: Čirč 14 July, 1974; Ruská Vol'a 9 Aug., 1974; Lenartov 29 Jan., 1975 and 10-12 Nov., 1981; Hertník 26-28 Aug., 1980; Livov 20-23 April, 1982. Some material of fleas from pitfall traps (Čirč-Minčol, 1975) were obtained through the kindness of Dr. J. KLEINERT.

The localities are situated in the forest zone between 550 and 1000 m above sea-level. The forests belong to the beech vegetation zone with autochtonous occurrence of fir-trees (Abies alba). Detailed locality and habitat descriptions are given by MÉSZÁROS & STOLLMANN (1984).

The following host species were examined (in parenthesis number of hosts examined/number of hosts infested): Sorex araneus Linnaeus (56/21); S. minutus Linnaeus (11/0); S. alpinus Schinz (7/5); Neomys fodiens (Pennant) (9/3); N. anomalus Cabrera (1/1); Apodemus flavicollis (Melchior) (40/15); A. agrarius (Pallas) (9/3); Clethrionomys glareolus (Schreber)

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(219/111); Pitymys subterraneus (de Sélys-Longchamps) (57/51); Microtus arvalis (Pallas) (9/6); Muscardinus avellanarius Linnaeus (1/0).

The material of this study is deposited partly in the Sarišské muzeum Bardejov and partly in the Research Station of the Institute of Experimental Biology and Ecology, Slovak Academy of Sciences, Staré Hory.

RESULTS

Fleas of 19 species were found on 9 insectivores and rodent species. A survey of the total material is given in Table 1. From ecological point of view the major part of the flea community of small mammals is composed of polyzonal species. Some of them are distributed over several vegetation zones from lowland forests to alpine meadows, e. g. Ctenophthalmus agyrtes ssp., Megabothris turbidus, Palaeopsylla soricis ssp., Hystrichopsylla orientalis, Doratopsylla dasycnema ssp., Peromyscopsylla bidentata and Amalaraeus arvicolae are characteristic only for European deciduous and mixed forests; in forest-steppe or oak vegetation zones Ctenophthalmus solutus and Nosopsyllus fasciatus are prevalent. Montane species were also recorded, some of them with montane or boreomontane type of distribution: Atyphloceras nuperus, Ctenophthalmus obtusus, Amalaraeus penicilliger kratochvili, Palaeopsylla steini and Ctenophthalmus uncinatus, Rhadinopsylla integella.

Table 1 Survey of small mammal fleas from the Čergov Mts

Locality / Flea species	Čergov Mts 1974-1975	Hertník 26 -28 8. 1980	Lenartov 10 -12 11. 1981	Livov 20 -23 4. 1982	Total ♂ ♀	Total n
Hystrichopsylla orientalis	0/1	1/0	0/1	0/1	1/3	4
Atyphloceras nuperus	-	-	3/3	0/1	3/4	7
Ctenophthalmus agyrtes	7/18	14/19	25/24	96/145	142/206	348
Ctenophthalmus solutus	1/1	-	-	-	1/1	2
Ctenophthalmus obtusus	-	-	-	11/5	11/5	16
Ctenophthalmus uncinatus	0/1	3/9	1/3	12/17	16/30	46
Doratopsylla dasycnema	12/6	3/0	9/2	1/0	25/8	33
Palaeopsylla soricis	6/4	0/1	39/25	2/0	47/30	77
Palaeopsylla similis	-	-	1/0	-	1/0	1
Palaeopsylla steini	-	-	1/1	-	1/1	2
Rhadinopsylla penthacantha	-	-	-	5/4	5/4	9
Rhadinopsylla cf. isacantha	-	-	0/2	4/4	4/6	10
Rhadinopsylla integella	1/0	0/1	7/8	5/2	13/11	24
Peromyscopsylla bidentata	-	-	14/22	0/1	14/23	37
Amalaraeus penicilliger	2/5	8/29	45/38	32/36	87/108	195
Amalaraeus arvicolae	1/0	1/0	3/0	30/31	35/31	66
Megabothris turbidus	0/2	8/37	-	-	8/39	47
Nosopsyllus fasciatus	-	-	0/1	-	0/1	1
Ceratophyllus sp.	-	-	-	0/1	0/1	1
Total	30/38	38/96	148/130	198/248	414/512	926
	68	134	278	446	926	926

Among the polytypic species which are represented by at least two well-distinguished geographical races in Slovakia, we found the eastern subspecies in the Čergov Mts in all cases. In the populations of Ctenophthalmus agyrtes kleinschmidtianus and Doratopsylla dasycnema cuspis we have found slight influence of western (e. g. Central-European) subspecies as manifested by their phenotype in the morphology of the male terminalia.

REVIEW OF RECORDED SPECIES

HYSTRICHOPSYLLIDAE

Hystrichopsylla orientalis orientalis Smit, 1956

Collection data: Čirč-Minčol 1975 - PT (pitfall trap) 0/1*; Hertník 26-28 Aug., 1980 - 1/0 on P. subterraneus; Lenartov 10-12 Nov., 1981 - 0/1 on S. araneus; Livov 20-23 April 1982 - 0/1 on P. subterraneus.

Atyphloceras nuperus (Jordan, 1931)

Collection data: Lenartov 10-12 Nov., 1981 - 3/3 on 5 C. glareolus and 1 P. subterraneus.

Note. Characteristic for montane conditions, but a not very numerous member of the autumn-winter flea synusia of the bank vole.

Ctenophthalmus solutus solutus Jordan & Rothschild, 1920

Collection data: Ruská Vol'a 9 July, 1974 - 1/1 on A. flavicollis.

Note. This species accompanies the yellow-necked field-mouse to the edge of the montane zone (oak stage). It seems to be absent in the deep valleys and higher vegetation zones (beech forests).

Ctenophthalmus agyrtes kleinschmidtianus Peus, 1950

Collection data: Ruská Vol'a 9 March, 1974 - 3/7 on C. glareolus; Čirč 14 July, 1974 - 2/3 on C. glareolus; Čirč-Minčol 1975 - PT, 1/5; Lenartov 29 Jan., 1975 - 1/3 on C. glareolus; Hertník 26-28 Aug., 1980 - 14/19; Lenartov 10-12 Nov., 1981 - 25/24; Livov 20-23 April, 1982 - 96/145 on 180 P. subterraneus, 107 C. glareolus, 12 M. arvalis, 10 A. flavicollis, 11 S. araneus, 2 A. agrarius, 1 N. fodiens.

Note. The investigated area belongs to the eastern border of the wide introgression zone of two subspecies of Ctenophthalmus agyrtes (Haller, 1896). The majority of the examined males (142 specimens), clearly bear the patterns of the subspecies kleinschmidtianus Peus in all the investigated localities. The different ratios of males in single localities are intermediate between C. agyrtes peusianus Rosický and C. agyrtes kleinschmidtianus Peus in the shape of the aedeagal lamella and the fixed process of the clasper. Only the population from locality Hertník seems to be uniformly C. a. kleinschmidtianus Peus.

Ctenophthalmus obtusus Jordan & Rothschild, 1912

Collection data: Livov 20-23 April, 1982 - 5/2 on 5 P. subterraneus, 2 C. glareolus; Lenartov 23 April, 1982 - 6/2 on P. subterraneus.

Note. A locally distributed species in the central part of the mountain. It is possible to observe an evident host segregation between C. obtusus and the other congeneric species. In case of syntopic occurrence of both species the former prefers the pine vole (P. subterraneus). There was only one case of synoxenous presence of both species during the investigation period.

Ctenophthalmus uncinatus uncinatus (Wagner, 1898)

Collection data: Čirč-Minčol 1975 - PT, 0/1; Hertník 26-28 Aug., 1980 - 3/9; Lenartov 10-12 Nov., 1981 - 1/3; Livov 20-23 April, 1982 - 12/17 on 31 C. glareolus, 8 P. subterraneus, 2 S. araneus, 2 A. flavicollis, 1 A. agrarius, 1 M. arvalis.

Note. This species is distributed all over the studied area. It shows preference first of all for the bank vole (C. glareolus) among the 6 ascertained host species. The majority of the specimens (69%) was collected from this host.

Doratopsylla dasycnema cuspis (Rothschild, 1915)

Collection data: Čirč-Minčol 1975 - PT, 12/5; Hertník 26-28 Aug., 1980 - 3/0; Lenartov 10-12 Nov., 1981 - 9/2; Livov 21 April, 1982 - 1/0 on 8 S. araneus and 7 S. alpinus.

Note. A not very numerous species during the whole period of the investigation. A slight influence of the nominate subspecies was noted in the population from Čirč (western slopes of mountain) in the shape of the male terminalia and the 7th sternum of the females.

*Number of males/number of females.

The vhole area east of the High Tatra to the Čergov Mts belongs to the introgression zone of both subspecies (unpublished material).

Palaeopsylla soricis starki Wagner, 1930

Collection data: Čirč-Minčol 1975 - PT, 6/4; Hertník 26-28 Aug., 1980 - 0/1; Lenartov 10-12 Nov., 1981 - 39/25; Livov 23 April, 1982 - 2/0 on 46 S. araneus, 7 S. alpinus, 1 N. fodiens, 1 N. anomalus.

Note. The eastern subspecies of P. soricis (Dahle) occurs all over the Čergov Mts in the pure from of its race. The whole material was collected from shrews.

Palaeopsylla similis similis Dampf, 1910

Collection data: Lenartov 10-12 Nov., 1981 - on N. anomalus.

Note. Mostly a parasite species of the genus Neomys, it was found on other insectivores only accidentally. A true parasite of the mole (T. europaea).

Palaeopsylla steini Jordan, 1932

Collection data: Lenartov 10-12 Nov., 1981 - 1/1 on S. araneus and N. fodiens.

Note. Its host preference is similar to that of the previous species. A rare autumn-winter flea with a distribution in the mountain ranges of the Carpathians and Balkan mountains. It is known from series of localities in Slovakia.

Rhadinopsylla pentacantha (Rothschild, 1897)

Collection data: Livov 20-23 April, 1982 - 5/4 on 7 C. glareolus, 2 P. subterraneus.

Rhadinopsylla aff. isacantha (Rothschild, 1907)

Collection data: Lenartov 10-12 Nov., 1981 - 0/2; Livov 20-23 April, 1982 - 4/4 on P. subterraneus.

Note. The systematic position of the population from the Carpathians is not clear. This isacantha-like species (females with Smit's organ) were identified as R. pitymydis (Zavattari) in previous papers (SKURATOWICZ, 1966; RYBA & ROSICKÝ, 1975). A rare member of the winter flea synusia of the pine vole (P. subterraneus).

Rhadinopsylla integella Jordan & Rothschild, 1921

Collection data: Ruská Vol'a 9 July, 1974 - 1/0 on C. glareolus; Hertník 26-28 Aug., 1980 - 0/1; Lenartov 10-12 Nov., 1981 - 7/8; Livov 20-23 April, 1982 - 5/2 on 20 C. glareolus, 2 P. subterraneus, 1 S. araneus.

Note. A not very numerous but stable element of the winter-shiphonapterium of the bank vole (C. glareolus).

LEPTOPSYLLIDAE

Peromyscopsylla bidentata bidentata (Kolenati, 1860)

Collection data: Lenartov 10-12 Nov., 1981 - 14/22; Livov 20 April, 1982 - 0/1 on 35 C. glareolus, 1 P. subterraneus, 1 S. araneus.

CERATOPHYLLIDAE

Amalaraeus penicilliger kratochvili Rosický, 1955

Collection data: Čirč 14 July, 1974 - 1/2 on C. glareolus; Čirč-Minčol 1975 - PT, 0/1; Hertník 26-28 Aug., 1980 - 8/28; Lenartov 10-12 Nov., 1981 - 45/38; Livov 20-23 April, 1982 - 32/36 on 170 C. glareolus, 15 P. subterraneus, 1 M. arvalis, 1 A. flavicollis, 1 S. araneus.

Note. A very common and numerous species in the flea synusia of the bank vole all year around. The study area lies on the eastern border of its distribution in the Slovak Carpathians.

Amalaraeus arvicolae (Ioff, 1950)

Collection data: Čirč-Minčol 1975 - PT, 1/0; Hertník 26-28 Aug., 1980 - 1/0; Lenartov 10-12 Nov., 1981 - 3/0; Livov 20-23 April,1982 - 30/31 on 61 P. subterraneus, 2 C. glareolus, 2 M. arvalis.

Note. A not very rare flea species parasitizing pine voles (P. subterraneus). It occurs

on other microtine rodents only accidentally. The very remarkable niche segregation between the previous congeneric species and A. arvicolae (Ioff) is achieved first of all by host preference.

Megabothris turbidus (Rothschild, 1909)

Collection data: Čirč-Minčol 1975 - PT, 0/1; Lenartov 29 Jan., 1975 - 0/1 on A. flavicollis; Hertník 26-28 Aug., 1980 - 8/37 on 22 C. glareolus, 15 A. flavicollis, 4 A. agrarius, 3 P. subterraneus, 1 S. alpinus.

Nosopsyllus fasciatus (Bosc, 1801)

Collection data: Lenartov 10-12 Nov., 1981 - 0/1 on A. flavicollis.

Note. This cosmopolitan and mostly synantropic species does not occur in natural montane conditions. Our only specimen was collected from a hemisynanthropic yellow-necked field-mouse which was trapped in a gamekeeper's cottage.

Ceratophyllus sp.

Collection data: Livov 20-23 April, 1982 - 0/1 on S. alpinus.

DISCUSSION

The studied area - Čergov Mts - belong to the greater geographical unit East Beskydy within the orographical subsystem of the Western Carpathians (MAZÚR & LUKNIŠ, 1978), situated just on their eastern margin. Analysing the flea fauna of the small mammals of the discussed region, we found a number of groups with different distribution pattern. Most important from zoogeographical point of view are, on one hand, species with limited distribution, e. g. oreal and boreo-oreal species, on the other hand, polytypic species with at least two geographical races in the investigated area. Six of the eight species with oreal or boreo-oreal type of distribution are continuously distributed over the montane zone of the Western and Eastern Carpathians (A. nuperus, C. obtusus, C. uncinatus, P. steini, R. aff. isacantha, R. integella). Two of them - A. penicilliger kratochvili with an oreal distribution over Central-European mountain ranges and Peromyscopsylla silvatica - an Eurosiberian species show different distribution patterns. The first one occurs in the studied area within its continuous range of distribution in the Western Carpathians. At the same time the eastern border of the distribution of this species passes through the Čergov Mts. The other part of the disjunct area of distribution in Europe is situated at a distance of over hundred kilometers east, in the Soviet Eastern Carpathians. Nearly the same distribution is shown by P. silvatica, but this species does not reach the Čergov Mts from the western part of its present disjunct area.

The eastern races of several polytypic species, such as C. agyrtes kleinschmidtianus, D. dasycnema cuspis and P. soricis starki also occur in the studied area. They also extend some distance westwards from the Čergov Mts to the western limit of their distribution (BARTKOWSKA, 1973, 1977; HAITLINGER, 1978; RYBA, 1977).

The distribution patterns of these two species-groups point out from zoogeographical point of view the transitional position of investigated area between the Western and Eastern Carpathians.

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